

REMARKS

Applicants respectfully request reconsideration of the application in view of the following remarks and the attached **Rule 132 Declaration**.

The present invention as set forth in **Claim 1** relates to a photoreceptor, comprising:

an electroconductive substrate;

a charge generation layer located overlying the electroconductive substrate optionally with an intermediate layer therebetween; and

a charge transport layer formed overlying the charge generation layer using a non-halogenated solvent and comprising a charge transport material and a resin;

wherein the charge generation layer comprises

a polyvinyl acetal resin, and

a charge generation material having an average particle diameter less than a roughness of a surface of either the electroconductive substrate or the intermediate layer, on which the charge generation layer is located;

wherein the average particle diameter of the charge generation material is not greater than 0.3 μm and not greater than 2/3 of the roughness of the surface of either the electroconductive substrate or the intermediate layer;

wherein the charge generation material is a titanyl phthalocyanine;

wherein the titanyl phthalocyanine has an X-ray diffraction spectrum in which a maximum peak is observed at a Bragg (2θ) angle of $27.2^\circ \pm 0.2^\circ$ when a Cu-K α X-ray having a wavelength of 1.542 Å is used;

wherein the titanyl phthalocyanine further has a lowest angle peak at an angle of $7.3^\circ \pm 0.2^\circ$, and wherein an interval between the lowest angle peak to a next peak at a high angle side is not less than 2.0° ;

wherein the titanyl phthalocyanine has a peak at an angle of 9.5° and a peak at an angle of 9.7° ;

wherein the titanyl phthalocyanine has no peak at an angle of 26.3° ; and

wherein said titanyl phthalocyanine has a peak in the X-ray diffraction spectrum at an angle of $23.5^\circ \pm 0.2^\circ$.

Claim 28 relates to a photoreceptor, comprising:

an electroconductive substrate;

a charge generation layer located overlying the electroconductive substrate optionally with an intermediate layer therebetween; and

a charge transport layer formed overlying the charge generation layer using a non-halogenated solvent and comprising a charge transport material and a resin;

wherein the charge generation layer comprises

a polyvinyl acetal resin, and

a titanyl phthalocyanine having an average particle diameter less than a roughness of a surface of either the electroconductive substrate or the intermediate layer, on which the charge generation layer is located,

wherein the titanyl phthalocyanine has an X-ray diffraction spectrum in which a maximum peak is observed at a Bragg (2θ) angle of $27.2^\circ \pm 0.2^\circ$ when a Cu-K α X-ray having a wavelength of 1.542 \AA is used,

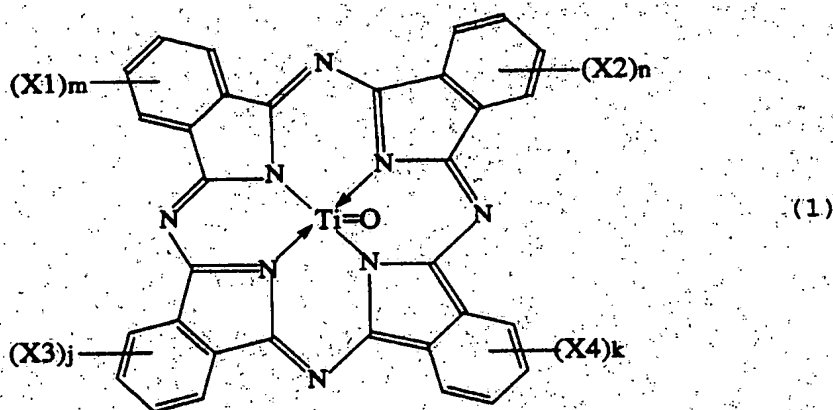
wherein the titanyl phthalocyanine further has a lowest angle peak at an angle of $7.3^\circ \pm 0.2^\circ$, and wherein an interval between the lowest angle peak to a next peak at a high angle side is not less than 2.0° ;

wherein the titanyl phthalocyanine has a peak at an angle of 9.5° and a peak at an angle of 9.7° ;

wherein the titanyl phthalocyanine has no peak at an angle of 26.3° ;

wherein the average particle diameter of the charge generation material is not greater than $0.3\ \mu\text{m}$ and not greater than $2/3$ of the roughness of the surface of either the electroconductive substrate or the intermediate layer; and

wherein said titanyl phthalocyanine is represented by formula (1)



wherein X1, X2, X3 and X4 independently represent a halogen atom, and m, n, j and k are independently 0 or an integer of from 1 to 4; and

wherein said titanyl phthalocyanine has a peak in the X-ray diffraction spectrum at an angle of $23.5^\circ \pm 0.2^\circ$.

New Claims 30 and 31 have been added.

The rejection of Claims 1, 7-23 and 28 under 35 USC § 112, 1st paragraph, is traversed.

The Examiner has stated that the original specification does not provide an adequate description of “a peak ...at an angle of $23.5^\circ \pm 0.2^\circ$ ”. See Claims 1 and 28. The Examiner states that the Figures do not provide support for this limitation. Applicants disagree.

Applicants previously submitted a **Rule 132 Declaration** with the raw data of the X-ray diffraction spectrum illustrated in FIG. 13 of the present invention to show that there is a

peak (i.e., the **peak No. 18**) at a 2θ angle of $23.5 \pm 0.2^\circ$. Therefore, the peak is clearly supported by FIG. 13 (and the raw data thereof).

Applicants are now submitting a **new Rule 132 Declaration** with enlarged views (i.e., FIGS. 13-1 and 13-2) of FIG. 13. It is clear from FIG. 13-1 that there is a peak at 23.5° . Therefore, claims 1, 7-23 and 28 are supported by FIG. 13 (13-1).

Similarly, it is clear from FIG. 13-2 that there are peaks at $9.4 \pm 0.2^\circ$ and $9.6 \pm 0.2^\circ$. Therefore, claims 1, and 28 are supported by FIG. 13 (13-2).

Moreover, a typographical error has been corrected in Table 1 of the specification as supported by the Japanese priority document which is also incorporated by reference into the specification (see page 96 of the specification). A certified English translation of Table 1 of the priority document JP2002-306757, filed on October 22, 2002, is attached herewith. The angle "9.6" in a passage "Peak in a range of 74° to 9.6" was amended to read "Peak in a range of 74° to 9.4".

It is clear from the data of the X-ray diffraction spectrum illustrated in FIG. 13 that there are peaks at 7.280° and 9.460° , and there is no peak therebetween. Therefore, this result meets the requirement of claim 1 (i.e., a peak is observed at an angle of $7.3^\circ \pm 0.2^\circ$ and the interval between the peak of $7.3^\circ \pm 0.2^\circ$ and the next peak at the high angle side is not less than 2.0°). Please note the interval between 9.460° and 7.280° is 2.180° . Therefore, Applicants believe that there is no inconsistency between the Rule 132 Declaration (filed January 29, 2007), and the specification. In addition, as mentioned above, claim 1 is supported by FIG. 13.

The lowest angle peak is observed at an angle of $7.3^\circ \pm 0.2^\circ$ and the interval between the lowest angle and the next peak at the high angle side is not less than 2.0° . As mentioned

in the former response, the lowest angle peak at $7.3^{\circ} \pm 0.2^{\circ}$ is different from the conventional 7.5° peak.

The examiner says that claim 1 includes a subject matter such that there is no peak between 7.6° ($7.5^{\circ} = 7.3 + 0.2$) to 9.5° or 7.2° ($7.1^{\circ} = 7.3 - 0.2$) to 9.1° . However, the lowest angle peak is observed at an angle of $7.3^{\circ} \pm 0.2^{\circ}$ and the interval between the lowest angle and the next peak at the high angle side is not less than 2.0° , and is not whether the peak at 9.4° is included therein.

Thus, this rejection should be withdrawn.

Previously, enlarged views of FIGS. 1-9 of Nukuda were submitted to show the positions of the peaks in an angle range of from 19° to 26° .

There is no peak around 23.5° except for FIG. 4, and a peak may be present at an angle lower than 23.5° in FIG. 4. Even if this was a peak, the peak is not present at 23.5° and therefore the peak is not the 23.5° peak.

The X-ray diffraction spectrum of the titanylphthalocyanine of Nukuda is different from that of the present invention because different synthesizing methods are used.

The method for synthesizing the titanylphthalocyanine of Nukuda is described in col. 3, line 30 to col. 4, line 30. The synthesizing method is characterized in that the titanylphthalocyanine dissolved in concentrated sulfuric acid is added into an organic solvent to precipitate a crystal. In addition, it is also described therein that the precipitated crystal is isolated and washed, or is subjected to a grinding treatment. However, no crystal change operation is performed thereafter. Namely, the desired crystal form is imparted to the titanylphthalocyanine by adding the sulfuric acid solution into an organic solvent.

The following is the description of Nukuda in col. 3, line 30 to col. 4, line 30.

"Titanyl phthalocyanine synthetically prepared is poured into 1 to 100 times the weight, and preferably from 3 to 50 times the weight, of concentrated sulfuric acid having a concentration of from 70 to 100%, and preferably from 90 to 100%, at a temperature of from 20° to 100°C, and preferably from 0° to 60°C, to form a solution or a slurry.

The resulting solution or slurry is then poured into a solvent to precipitate a crystal. The solvent which can be used for precipitation is selected from alcohol solvents, aromatic solvents, mixed solvents of an alcohol solvent and water, mixed solvents of an alcohol solvent and an aromatic solvent, and mixed solvents of an aromatic solvent and water. Examples of the alcohol solvents include methanol and ethanol. Examples of the aromatic solvents include benzene, toluene, monochlorobenzene, dichlorobenzene, trichlorobenzene, and phenol. In using a mixed solvent, the alcohol solvent to water weight ratio is from 100/0 to 10/90, and preferably from 100/0 to 40/60; the alcohol solvent to aromatic solvent weight ratio is from 100/0 to 10/90, and preferably from 100/0 to 50/50; and the aromatic solvent to water weight ratio is from 100/0 to 1/99, and preferably from 60/40 to 5/95.

The amount of the solvent to be used ranges from 2 to 50 times, and preferably from 5 to 20 times, the volume of the concentrated sulfuric acid solution or slurry. The temperature of the solvent is set at 0 to 50°C, and preferably 10°C or lower.

The precipitated crystal is collected by filtration and washed with an appropriate solvent, or the collected crystal is subjected to a solvent treatment or a grinding treatment in a solvent.

Examples of the solvent which can be used for the washing or the solvent treatment include an alcohol solvent, an aromatic solvent, a mixed solvent of an alcohol solvent and water, a mixed solvent of an alcohol solvent and an aromatic solvent, and a mixed solvent of an aromatic solvent and water. The washing with a solvent or the solvent treatment can be carried out by stirring the isolated titanylphthalocyanine crystal in the above-mentioned solvent at a temperature of from room temperature to 100°C for a period of from 1 to 5 hours.

Examples of apparatus to be used for the grinding treatment include, while not being limited, an attritor, a roll mill, a ball mill, a sand mill, and a homomixer. The amount of the solvent to be used for the grinding treatment preferably ranges from 5 to 50 times the weight of titanyl phthalocyanine. Examples of the solvents to be used include for the grinding treatment water, an alcohol solvent, an aromatic solvent, a mixed solvent of an alcohol solvent and water, a mixed solvent of an alcohol solvent and an aromatic solvent, and a mixed solvent of an aromatic solvent and water. Examples of the alcohol solvents include methanol and ethanol. Examples of the aromatic solvents include benzene, toluene, monochlorobenzene, dichlorobenzene, trichlorobenzene, and phenol. In using a mixed solvent, the alcohol to water weight ratio is from 100/0 to 10/90, and preferably from 100/0 to 50/50; the alcohol solvent to aromatic solvent weight ratio is from 100/0 to 10/90, and preferably from 100/0 to 50/50; and the aromatic solvent to water weight ratio is from 100/0 to 1/99, and preferably from 60/40 to 3/97."

In contrast, in the synthesizing method of the present invention, an acid paste treatment in which the titanylphthalocyanine dissolved in concentrated sulfuric acid is precipitated in water to prepare amorphous titanylphthalocyanine is performed, and then a

crystal changing operation using an organic solvent is performed to prepare a titanylphthalocyanine crystal having the desired crystal form. This is described in cols. [0109]-[0117] of the publication of the present specification.

Thus, the synthesizing method of the present invention is largely different from the synthesizing method of Nukuda, and therefore the products produced by the different synthesizing methods are different from each other.

Further, the Examiner states that in Claims 1 and 28, "a peak at an angle of 9.5° and a peak at an angle of 9.7°" is not supported by the original specification or the Figures or Examples. However, these peaks are also supported by the raw data of FIG. 13. See the Rule 132 Declaration. The raw data show two clear peaks, i.e., **peaks Nos. 2 and 3**. This difference is also caused by the different synthesizing methods. Thus, this rejection should be withdrawn.

The rejections of the Claims over Niimi ('633), ACS File Registry, Hashimoto, Takaya, Hashimoto, Takaya and Niimi ('654), Oshiba, JP '358, Ladd et al, Tamura are traversed.

Niimi ('633), ACS File Registry, Hashimoto, Takaya and Niimi ('654) and Oshiba, JP '358, Ladd et al, Tamura fail to disclose or suggest the superior properties of the claimed photoreceptors as set forth in the specification.

In order to protect environment, it is desired not to use a halogenated solvent when a photoreceptor is produced, particularly when a charge transport layer is prepared (because a large amount of solvent is used for preparing a charge transport layer). The object of the present invention is to prepare a charge transport layer without using a halogenated solvent. If a halogenated solvent is merely replaced with a non-halogenated solvent, the resultant

photoreceptor is inferior in characteristics (such as photosensitivity). The reason therefore is as follows.

When a charge transport layer coating liquid including a non-halogenated solvent is coated on a charge generation layer, the charge generation material therein aggregates due to the solvent and thereby the specific surface area of the charge generation material decreases. Therefore, the probability that the charge generation material contacts with the charge transport material decreases, resulting in deterioration of photo-carrier generation efficiency, i.e., deterioration of photosensitivity. Therefore, it is necessary to prevent occurrence of aggregation of the charge generation material to avoid the photosensitivity deterioration problem. This can be achieved by controlling the surface roughness of the intermediate layer and the particle size of the charge generation material, the charge generation material aggregation problem can be avoided.

In other words, only after the following four points are understood, the present invention can be made:

- 1) to use a non-halogenated solvent;
- 2) when a non-halogenated solvent is used for preparing a charge transport layer on a charge generation layer, the charge generation material aggregates;
- 3) when the charge generation material aggregates, the photosensitivity of the resultant photoreceptor deteriorates; and
- 4) by controlling the surface roughness and the particle size of charge generation material, the charge generation material aggregation problem can be avoided.

Since these points are not disclosed and suggested in Niimi ('633), ACS File Registry, Hashimoto, Takaya and Niimi ('654) and Oshiba, JP '358, Ladd et al, Tamura the present invention is not obvious.

Specifically, there is no disclosure in these references that agglomeration of the charge generation layer can be avoided as disclosed at pages 17 and 18 of the specification.

There is also no disclosure of the superior results obtained in the Examples of the present invention. See pages 82-84 of the specification.

Table 2

	Solvent of CTL liquid	Ave. particle diameter (μm)	Surface roughness (μm)	Image qualities		VL (-V)	
				Back-ground fouling	Image density	At the start of test	At the end of test
Ex. 1	THF	0.2	1.0	○	○	90	95
Ex. 2	THF	0.2	0.6	○	○	85	95
Ex. 3	THF	0.2	0.3	Δ	○	85	90
Ex. 4	THF	0.2	0.4	○	○	95	105
Ex. 5	THF	0.6	1.0	Δ	○	100	125
Ex. 6	Dioxolan	0.2	1.0	○	○	100	110
Ex. 7	THF/toluene	0.2	1.0	○	○	80	85
Comp. Ex. 1	THF	0.2	-	X	X	100	160
Comp. Ex. 2	THF	0.6	0.6	X	Δ	110	150
Comp. Ex. 3	THF	0.6	0.3	X	X	100	170
Comp. Ex. 4	THF	0.6	0.4	X	X	115	165
Comp. Ex. 5	THF	0.6	-	X	X	120	180
Comp. Ex. 6	Dioxolan	0.2	-	X	X	130	200
Comp. Ex. 7	THF/Toulene	0.2	-	X	X	100	160
Ref. Ex. 1	Dichloro-methane	0.2	1.0	Δ	○	85	90
Ref. Ex. 2	Chloroform	0.2	1.0	Δ	○	95	100
Ex. 8	THF	0.2	0.6	Δ	Δ	115	145
Ex. 9	THF	0.2	0.6	Δ	Δ	105	135
Ex. 10	THF	0.2	0.6	Δ	Δ	110	140
Ex. 11	THF	0.2	0.6	Δ	Δ	105	140
Ex. 12	THF	0.2	0.6	Δ	Δ	110	145
Ex. 13	THF	0.2	0.6	Δ	Δ	105	135
Ex. 14	THF	0.2	0.6	⊙	⊙	85	95
Ex. 15	THF	0.2	0.6	⊙	○	80	90
Ex. 16	THF	0.2	1.0	Δ	○	100	120
Comp. Ex. 8	THF	0.2	1.0	X	Δ	100	145

As can be understood from Table 2, the photoreceptors of Examples 1 to 16, whose CGL is formed without using halogen-containing solvents, can maintain good photosensitivity even when used for a long period of time. Therefore, the photoreceptors can stably produce good images.

In addition, as can be understood from comparison of the photoreceptor of Example 2 with the photoreceptors of Examples 8 to 13, a TiOPc having a maximum peak at a Bragg (2θ) angle of $27.2^\circ \pm 0.2^\circ$ and a lowest angle peak at $7.30^\circ \pm 0.2^\circ$ without having a peak in an angle range of from 7.4° to 9.4° and at an angle of 26.3° is used, the resultant photoreceptor

has relatively good properties compared to the photoreceptors using other TiOPc. In addition, when the CGL coating liquid is filtered with a filter having an effective pore diameter of 3 μm to remove large particles therein (Example 15) or a TiOPc synthesized so as to have a relatively small particle diameter is used (Example 14), the resultant photoreceptors have better properties than the photoreceptor of Example 2.

These superior results are not disclosed or suggested by Niimi ('633), ACS File Registry, Hashimoto, Takaya and Niimi ('654) and Oshiba, JP '358, Ladd et al, Tamura.

The Examiner's comment that Niimi '633 includes an example in which a charge transport layer (CTL) is formed using a tetrahydrofuran (THF), which is a non-halogenated solvent, is correct. Each of all the photoreceptors (e.g., Examples 1-17) including a CTL prepared by using THF necessarily includes a charge generation layer (CGL) including an azo dye. In contrast, the photoreceptor of Example 28 including a CGL including a TiOPc crystal uses methylene chloride (a halogenated solvent) for forming the CTL. Among the photoreceptors of Niimi '633, only the photoreceptor of Example 28 uses a halogenated solvent for forming the CTL. This is because THF could not be used for forming the CTL. In contrast, since the CGLs of the photoreceptors of the present invention fulfill the preferable conditions of the surface roughness and particle size of TiOPc, the problem of agglomeration of TiOPc in the CGL can be avoided even when a non-halogenated solvent is used for forming the CTL.

Regarding Oshiba, the examiner misunderstands the reference. In Examples 1-7 of Oshiba, 1,2-dichloroethane (a halogenated solvent) is used for forming the CTLs. In addition, it is described in the specification of Oshiba (col. 30, line 47) that dichloromethane, 1,2-dichloroethane (each of the solvents is a halogenated solvent), and methyl ethyl ketone are preferably used as the coating solvent. This means that Oshiba mentions that halogenated

solvents are preferably used. Therefore the examiner's comment such that it is described in Oshiba that non-halogenated solvents are preferably used is incorrect.

The examiner's comment such that the photoreceptors of Reference Examples 1 and 2 exhibit similar results as those of the photoreceptors of Examples 1-7 lacks focus. It is well known that use of a halogenated solvent itself is not earth-friendly. It is an object of the present invention **not to use a halogenated solvent**. The photoreceptors of Reference Examples 1 and 2 exhibit good performance and therefore have been used in past years. The truth that the photoreceptors of Examples 1-7 exhibit similar results as those of the photoreceptors of Reference Examples 1 and 2 means that the photoreceptors of Examples 1-7 can exhibit good performance, namely the level of this invention is high. The difference in performance between the photoreceptors of Examples 1-7 and the comparative photoreceptors is large.

Niimi '633 and Oshiba have disclosed that **halogenated solvents** are used for forming (CTLs of) photoreceptors including a TiOPc (in the CGLs). Therefore, Niimi '633 and Oshiba do not answer for the purpose (use of non-halogenated solvents to make environmental protection) of the present invention. Niimi '633 and Oshiba are similar to Reference Examples 1 and 2 of the present application. The photoreceptors of Reference Examples 1 and 2 are comparative examples in view of the concept of the present invention. As mentioned above, it is incorrect to compare the performance of the photoreceptors of Reference Examples 1 and 2 with that of the photoreceptors of Examples 1-7.

For example, assuming that a CTL is formed using a non-halogenated solvent instead of methylene chloride in Example 28 of Niimi '633. In this case, the resultant photoreceptor will exhibit performance similar to that of Comparative Examples 2-5 because the particle size of the TiOPc crystal in the CGL is not particularly controlled.

In addition, it is described in col. 43, lines 44-56 of Oshiba that **halogenated solvents** are used for forming (CTLs of) photoreceptors. Therefore, it is incorrect to compare the performance of the photoreceptors of the present invention with that of the photoreceptors of Oshiba.

Therefore, the rejections of the Claims over Niimi ('633), ACS File Registry, Hashimoto, Takaya and Niimi ('654) and Oshiba, JP '358, Ladd et al, Tamura, are believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of these rejections is respectfully requested.

The Examiner is requested to withdraw the **provisional** double patenting rejections over Serial Nos. 10/804,067, and 10/655,280 if they are the only remaining rejections in the case. See MPEP 822.01.

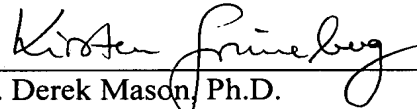
Application No.: 10/606,750

Reply to the Office Action dated: April 12, 2007

This application presents allowable subject matter, and the Examiner is kindly requested to pass it to issue. Should the Examiner have any questions regarding the claims or otherwise wish to discuss this case, he is kindly invited to contact Applicants' below-signed representative, who would be happy to provide any assistance deemed necessary in speeding this application to allowance.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



J. Derek Mason, Ph.D.
Registration No. 35,270

Customer Number
22850

Kirsten A. Grueneberg, Ph.D.
Registration No.: 47,297

Tel: (703) 413-3000
Fax: (703) 413 -2220
NFO:KAG: